matching circuit is shifted from the design value. Especially, this phenomenon appears remarkably in frequency bands referred to as millimeter wave bands over 30GHz.

Replace the paragraph beginning at page 1, line 27 with:

A2

In the case where a high frequency band is used, a matching circuit must be located close to a lead of each transistor, since wavelengths are short in high frequency bands such as millimeter wave bands. In spite of this, it is actually impossible to form such a matching circuit outside a semiconductor substrate. Generally, therefore, a monolithic microwave integrated circuit (MMIC) is employed for mobile radio communications, since it is formed together with a matching circuit on the same substrate. The MMIC mentioned here means a plurality of microwave circuits formed on one semiconductor chip after the respective microwave circuits are assembled with parts.

Replace the paragraph beginning at page 2, line 5 with:

A3

Figs. 10(A) and 10(B) show two examples of a conventional input side matching circuit. In Fig. 10(A), reference numeral 5 denotes an input terminal, reference numerals 10 and 12 denote lines, reference numeral 26 denotes a transistor, reference character L1 denotes an open stub capacitance (of the line 10), and reference character L2 denotes an inductance of the line 12. In Fig. 10(B), reference numeral 5 denotes an input terminal, reference numeral 12 denotes a line, reference numeral 26 denotes a transistor, reference numeral 38 denotes a capacitor, reference character C1 denotes an MIM capacitance (a total capacitance of the three layers; metal, insulator, and metal layers) of the capacitor 38, and reference character L2 denotes an inductance of the line 12. Reference character a denotes a point for denoting a gate-source capacitance when the point is viewed from the input side of the transistor 26, reference character c denotes a point when it is viewed together with the inductance L2, and reference character d denotes a point when it is viewed together with the open stub capacitance L1 from the input terminal 5. As shown in Figs. 10(A) and 10(B), the capacitor C1, etc. having an MIM capacitance and the transistor 26 are patterned on the same substrate.

Replace the paragraph beginning at page 2, line 22 with:

A4

Fig. 11 is a Smith chart for an input side matching circuit shown in Fig. 10. In Fig. 11, the same reference numerals are given to the same items as those shown in Fig. 10, avoiding redundant description. In Fig. 11, reference symbol Cgs denotes a simplified gate-source capacitance seen typically in an input side equivalent circuit of the transistor 26. As shown in Fig. 11, the impedance, at the time of viewing it from the input terminal 5 side in the design stage, moves to the point d on the Smith chart. The point d denotes 50Ω obtained by combining the gate-source capacitance Cgs, the inductance L2, and the open stub capacitance L1 or MIM capacitance C1.

Replace the paragraph beginning at page 2, line 31 with:

A5

As described above, the MMIC enables both of the capacitor C1 having an MIM capacitance and the transistor 26 to be formed on the same substrate, so an excessive insulation film (MIM insulation film) is formed unavoidably around the transistor 26 due to the fabrication method. Consequently, this excessive insulation film generates a parasitic capacitance, causing the electrical property of the transistor 26 to be changed. Table 1 shows results of a comparison performed with respect to the parasitic capacitance at input side and output side of the transistor 26 between when an MIM insulation film is formed and when not formed around the transistor 26.

Replace the paragraph beginning at page 3, line 11 with:

A6 Con't

As shown in Table 1, the capacitance Cgs[pF/mm] at the input side of the transistor 26 is 0.73[pF/mm] when no MIM insulation film is formed around the transistor 26 while it becomes 0.89[pF/mm] when an MIM insulation film is formed around the transistor 26. The capacitance Cgs[pF/mm] at the output side of the transistor 26 is 0.16[pF/mm] when no insulation film is formed around the transistor 26 while it becomes 0.22[pF/mm] when an MIM insulation film is formed around the transistor 26. That is, in the case where the MIM insulation film taken as an MIM capacitance changes due to the unevenness among fabrication processes, the capacitance components at both input and output sides of the transistor 26 are changed, thereby the matching point is shifted from the design and the property of the subject high frequency circuit changes.. Hereinafter,

A6

Included

this high frequency circuit property change will be described with respect to the input side impedance with reference to the Smith chart shown in Fig. 11. In Fig. 11, when the MIM insulation film is thick, the input side capacitance Cgs of the transistor 26 increases, so that the point a on the design is shifted to the point a' and the point c is shifted to the point c' due to the inductance L2. The input side impedance obtained when the inductance L2 is combined with the open stub capacitance L1 or MIM capacitance C1 is also shifted to the point d'. The impedance is thus shifted from the matching point.

Replace the paragraph beginning at page 4, line 6 with:

A7

On the other hand, when the matching circuit uses the MIM capacitance C1, a relationship denoted by the following Equation 1 is assumed between the MIM insulation film thickness L and the MIM capacitance C1.

Replace the paragraph beginning at page 4, line 11 with:

A8

Here, C1 denotes an MIM capacitance, ε denotes an inductance rate of the MIM insulation film, S denotes a pattern area of the MIM capacitor C1, and L denotes an MIM insulation film thickness. As shown in the expression 1, when the MIM insulation film thickness L increases, the MIM capacitance C1 decreases. On the Smith chart shown in Fig. 11, therefore, the input side impedance is further shifted to the point d", thereby the impedance is further shifted from the matching point.

Replace the paragraph beginning at page 4, line 18 with:

A9

According to the above description, it is considered that the same phenomenon also occurs for the output side impedance when the input side capacitance Cgs is replaced with the output side capacitance Cgd. That is, the impedance is shifted from the matching point due to a change of the MIM insulation film thickness L.